

DO NOT ENTER: /D.M./

EXPEDITED PROCEDURE
RESPONSE UNDER 37 C.F.R. §1.116

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of Confirmation No.: 9696
Jinbo Bai et al. Group Art Unit: 1736
Application No.: 10/587,546 Examiner: Daniel McCracken
Filed: January 5, 2007 Docket No.: 021305-00349
For: METHOD FOR OBTAINING CARBON NANOTUBES ON SUPPORTS AND COMPOSITES COMPRISING SAME

RESPONSE UNDER 37 C.F.R. §1.116

MAILS STOP AF
Commissioner for Patents
P.O. Box 1450
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Sir:

September 7, 2011

In reply to the June 9, 2011, Office Action, please consider the following:

Listing of claims begin on page 2; and

Remarks begin on page 5.

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LISTING OF CLAIMS:

1. (Previously Presented) A process for obtaining carbon nanotubes bound to nanometric and/or micrometric-sized composite reinforcement supports, said process comprising

contacting the supports with a mixture of a carbon source compound and a catalyst in a stream of inert gas and hydrogen, the step of contacting being effected by chemical vapor deposition (CVD),

wherein said at least one of said supports are not SiO₂ particles or wires comprising a metallic material.

2. (Previously Presented) The process as claimed in claim 1, further comprising heating, in a reaction chamber, the nanometric and/or micrometric-sized composite reinforcement supports, to a temperature of 600-1100°C, in the stream of inert gas;

cooling the chamber down to room temperature; and
recovering the carbon nanotubes bound to the nanometric and/or micrometric-sized reinforcement supports.

3. (Previously Presented) The process as claimed in claim 2, wherein the nanometric and/or micrometric-sized composite reinforcement supports are in the form of particles or fibers.

4. (Previously Presented) The process as claimed in claim 3, wherein the nanometric and/or micrometric-sized composite reinforcement supports are formed from carbon fibers; glass fibers; SiC particles and fibers, TiC particles and fibers, Al₂O₃ particles and fibers, SiO₂ fibers, B₄C particles and fibers; or clays.

5. (Previously Presented) The process as claimed in claim 1, wherein the carbon source compound is a liquid hydrocarbon or a gaseous hydrocarbon or a solid.

6. (Previously Presented) The process as claimed in claim 1, wherein the catalyst is an iron metallocene, a cobalt metallocene, a nickel metallocene, an iron nitrate, a cobalt nitrate, a nickel nitrate, an iron acetate, a cobalt acetate, a nickel acetate, an iron sulfate, a cobalt sulfate or a nickel sulfate.

7. (Previously Presented) The process as claimed in claim 1, wherein the catalyst and the carbon source compound are used in an amount from 0.001 to 0.1 g of catalyst per ml of compound.

8. (Previously Presented) The process as claimed in claim 1, wherein the ratio of inert gas to hydrogen is 5/95 to 50/50.

9. (Previously Presented) The process as claimed in claim 2, further comprising, before said heating, depositing a silicon compound on the surface of said supports.

10. (Previously Presented) The process as claimed in claim 9, wherein the silicon compound is SiO₂, or a silane.

11-13. (Cancelled)

14. (Previously Presented) The process as claimed in claim 5, wherein the carbon source compound is an alcohol or a ketone.

15. (Previously Presented) The process as claimed in claim 5 wherein the carbon source compound is selected from the group consisting of xylene, toluene, benzene, n-pentane; ethanol, methanol; acetone, acetylene, methane, butane, propylene, ethylene, propene and camphor.

16. (Previously Presented) The process as claimed in claim 1 wherein the catalyst is Fe(II) phthalocyanine (FePc) or iron pentacarbonyl (Fe(CO)₅).

17. (Previously Presented) The process as claimed in claim 9 wherein the silicon compound is SiC, SiCl₄, SiO or SiO₂.

REMARKS

The Office Action dated June 9, 2011, has been received and carefully noted.

The following remarks are being submitted as a full and complete response thereto.

This response is timely. Claims 1-10 and 14-17 are pending in this application.

Reconsideration of the application is respectfully requested.

The Office Action rejects claims 1-10 and 14-17 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Applicants submit that the written description of the current application clearly supports the features of "composite reinforcement supports" in the Specification at, for example, page 4, lines 27-32, page 10, lines 18-22, page 12, lines 7-11, and page 14, lines 1-4, which clearly describes the nanotube reinforcement supports as being nanoscale/microscale ceramic particles and/or fibers, carbon fibers, and the like, and also teach that the composite reinforcement supports are used to provide support for the growth of the carbon nanotubes and reinforce polymer, ceramic and metal matrices. Accordingly, withdrawal of the rejection of the claims under 35 U.S.C. §112, first paragraph, is respectfully requested.

The Office Action rejects claims 1-10 and 14-17 under 35 U.S.C. §112, second paragraph, as being indefinite. As discussed above, the claimed feature of "composite reinforcement supports" is clearly definite. Accordingly, withdrawal of the rejection of the claims under 35 U.S.C. §112, second paragraph, is respectfully requested.

The Office Action rejects claims 1-8 and 15 under 35 U.S.C. §103(a) as being obvious over Singh et al. ("Towards the production of large-scale aligned carbon nanotubes;" Chemical Physics Letters 2003, 372, pp. 860-865) in view of Ma et al. ("Processing and properties of carbon nanotubes – nano-SiC ceramic;" Journal of

Materials Science 1998, 33, pp. 5243-5246) and Wang et al. (U.S. Patent Application Publication No. 2003/0119920); claims 1-8 and 15-16 under 35 U.S.C. §103(a) as being obvious over Rao et al. ("Synthesis of multi-walled and single-walled nanotubes, aligned —nanotube bundles and nanorods by employing organometallic precursors;" Mat. Res. Innovat. 1998; 2, pp. 128-141) in view of Ma; claims 1-4 under 35 U.S.C. §103(a) as being obvious over Rao in view of Ma; claims 9-10 under 35 U.S.C. §103(a) as being obvious over Rao in view of Wang and Choi et al. ("Controlled deposition of carbon nanotubes on a patterned substrate;" Surface Science 2000; 462, pp. 195-202); claim 17 under 35 U.S.C. §103(a) as being obvious over Rao in view of Wang and Xu et al. ("A method for fabricating large-area, patterned, carbon nanotube field emitters;" Applied Physics Letters 1999, 74(17), pp. 2549-2551); and claims 1, 5 and 15 under 35 U.S.C. §103(a) as being obvious over Singh in view of in view of Ma, Wang, Smalley et al. (WO 00/17102) and Maruyama et al. ("Low-temperature synthesis of high-purity single-walled carbon nanotubes from alcohol;" Chemical Physics Letters 2002, 360, pp. 229-234). The rejections are respectfully traversed.

In particular, the current application claims a process for obtaining carbon nanotubes bound to nanometric and/or micrometric-sized composite reinforcement supports, the process including contacting the supports with a mixture of a carbon source compound and a catalyst in a stream of inert gas and hydrogen, the step of contacting being effected by chemical vapor deposition (CVD), wherein said at least one of said supports are not SiO₂ particles or wires comprising a metallic material, as recited in independent claim 1.

The Office Action impliedly admits that Singh fails to teach all the features of independent claim 1, and relies on Ma and Wang to cure this deficiency by arguing

that "[s]ubstitution of these [Ma's] supports for Singh reflects substitution of known elements" (Office Action, page 12, lines 3-12).

However, a closer examination of Ma reveals that there is no stream of inert gas and hydrogen in which a catalyst and a carbon source compound are contacted. Accordingly, combining the teachings of Singh with the teachings of Ma would result in either Ma having a stream of gas added to the process, or in Singh eliminating the gas stream. However, Singh without a gas stream would be inoperative, and Ma with a gas stream would also be inoperative. Accordingly, Applicants submit that the modification of either reference with respect to a streaming inert gas would render either reference inoperative for its intended purpose. As such, the combination of Singh and Ma to arrive at the claimed invention is improper, and a combination of Sing, Ma and Wang fails to arrive at the subject matter of independent claim 1.

The Office Action also admits that Rao fails to teach all the features of independent claim 1, and relies on Ma to cure this deficiency by arguing that "[o]ne would be motivated to grow nanotubes on SiC for any number of reasons, for example the elimination of the mixing step" (Office Action, page 13, lines 14-20). However, as discussed above, Ma fails to teach a stream of inert gas and hydrogen. Accordingly, similarly to the combinability of Singh and Ma, combining Rao and Ma would result in either Ma having a stream of gas added to the process, or in Rao eliminating the gas stream, which would render either reference inoperative for its intended purpose. As such, the combination of Rao and Ma to arrive at the claimed invention is improper.

Applicants further note that none of the other applied references cure the deficiencies of the above references in disclosing or rendering obvious the features of independent claim 1.

For at least a combination of the above-discussed reasons, independent claim 1 is patentable over a combination of all the applied references. Claims 2-10 and 14-17, at least for depending from patentable claim 1, and for the additional features recited therein, are also patentable over the applied references. Accordingly, all the pending claims are patentable, and withdrawal of the rejections of the claims under 35 U.S.C. §103(a) is respectfully requested.

Should the Examiner determine that further action is necessary to place this application into better form for allowance, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event that the fees are found to be insufficient, or if any additional fees are due with respect to this paper, please charge our Deposit Account No. 01-2300, referencing Attorney Docket No. 021305-00349.

Respectfully submitted,



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